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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/821,390	04/09/2004	Mark S. Wallace	040319	1595

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EXAMINER	
WONG, LINDA	

ART UNIT	PAPER NUMBER
2611	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/821,390	WALLACE ET AL.	
	Examiner	Art Unit	
	Linda Wong	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 April 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-52* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,6,10-13,15,17,19,21-26,29,32-36 and 39-52* is/are rejected.

7)☒ Claim(s) *3-5,7-9,14,16,18,20,27-28,30-31,37-38* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 April 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings were received on 4/9/2004. These drawings are accepted.

Claim Objections

2. **Claim 46** is objected to because of the following informalities: Claim 46 recites the variable "R", wherein R is not defined. For example, claim 46 recites the variable N and defines N as "an integer greater than 2" and as "columns" of the matrix recited. The examiner suggests the same format is used for the variable R. For the purpose of the prior art rejection below, the variable R will be defined as the rows the matrix recited. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. **Claims 1-2,6,10,12,15,17,19,21,24-25,29,32-33,35-36,40-42,45-52** are rejected under 35 U.S.C. 102(e) as being anticipated by Khayrallah et al (US Patent No.: 6711124).

   a. **Claims 1,17**,

i. Khayrallah et al discloses

- "obtaining a base matrix" (Abstract discloses using training sequence and scalar values to determine the channel estimate, Fig. 3 shows a diagram of the MxN matrix.)
- "selecting at least one different combination of scalars, each combination including at least one scalar for at least one row of the base matrix, one scalar per row, each scalar being a real or complex value" (Abstract discloses selecting a set of orthogonal scaling values. Col. 10, lines 54-60 shows an example of a scaling value matrix B, wherein the matrix B is shown to have real values and at least one row. Fig. 3 shows the matrix B, wherein the number of values within the row depends on N.) and
- "forming at least one steering matrix by multiplying the base matrix with the at least one different combination of scalars, wherein one steering matrix is formed by each combination of scalars". (Col. 5, lines 19-51 discloses using the scaling matrix to scale the transmit power of the training sequence.)

b. **Claim 2**, Khayrallah et al discloses "forming a plurality of steering vectors with columns of the at least one steering matrix". (Col. 5, lines 19-51 discloses producing channel estimate from the scaling value matrix and training sequence for each of the N antennas.)

c. **Claims 6,15,19,29,** Khayrallah et al discloses "each of the at least one steering matrix has orthogonal columns". (Abstract discloses the set of scaling values are orthogonal. Since the steering matrix is produce from the scaling values and training sequences, the steering matrix would have at least one orthogonal column.)

d. **Claim 10**, Khayrallah et al discloses "the base matrix has a dimension of N by N, where N is an integer greater than one, and wherein each combination includes N - 1 scalars for N - 1 rows of the base matrix". (Col. 5, lines 42-45 discloses "each row/column position in the matrix holds a scaling value for a corresponding one of the N transmit antennas." This indicates the base matrix or list of training sequences received would have the same dimension as the scaling value matrix.)

e. **Claim 12**, Khayrallah et al discloses "the at least one combination of scalars is obtained with a base-K counter having one digit for each of the at least one scalar in a combination, where K is the number of different possible scalars usable for each row of the base matrix". (Col. 5, lines 42-45 discloses "each row/column position in the matrix holds a scaling value for a corresponding one of the N transmit antennas.")

f. **Claim 21** inherits all the limitations of claim 1, but claim 1 fails to recite "processing data to obtain a block of data symbols to be transmitted in a plurality of transmission spans" and "performing spatial processing on at least one data symbol to be transmitted in each transmission span with the steering

matrix obtained for the transmission span, the spatial processing resulting in the block of data symbols observing a plurality of effective channels formed with the plurality of steering matrices." (Col. 2, lines 6-11 discloses the wireless communication system employs transmit diversity. Col. 3, lines 10-15 discloses a plurality of wireless access terminals and multiple transmit antennas. Col. 5, lines 53-63 discloses transmitting a scaled signal through each antenna.)

g. **Claim 24**, Khayrallah et al discloses "the plurality of transmission spans correspond to a plurality of time intervals." (Fig. 4 shows time intervals. Col. 2, lines 22-40 discloses transmission per antenna per time interval.)

h. **Claims 25,35,40**, Khayrallah et al discloses "each steering matrix has one column, and wherein one data symbol is transmitted in each transmission span." (Fig. 3 shows the training sequence is combined with the scalar per an antenna, wherein one antenna has one column.)

i. **Claims 26,36,41**, Khayrallah et al discloses "each steering matrix has multiple columns, and wherein multiple data symbols are transmitted simultaneously in each transmission span". (Fig. 3 shows the steering matrix is produced based on training sequence and scalar matrix, wherein training sequence per the antenna assigned are transmitted within the time interval. (Fig. 4))

j. **Claims 34,39** inherit all the limitations of claim 21.

k. **Claim 32**, Khayrallah et al discloses training sequences are transmitted using the steering matrices or scaling matrix as shown in Fig. 3. The external

receiver would not know the steering matrix but will use the training sequence for equalization. (Col. 1, lines 29-42)

l. **Claim 33**, Khayrallah et al discloses "the plurality of steering matrices are unknown to a receiving entity for the block of data symbols." (Fig. 6, label receiver uses the channel estimation from the memory.)

m. **Claim 42** inherits all the limitations of claim 1 or 21, but claim 1 fails to recite the limitations "deriving a plurality of spatial filter matrices based on a channel response estimate and a plurality of steering matrices", "obtaining, in the plurality of transmission spans, R sequences of received symbols via R receive antennas, where R is an integer one or greater" and "performing receiver spatial processing on the R sequences of received symbols with the plurality of spatial filter matrices to obtain detected symbols". Khayrallah et al discloses in Fig. 6 a receiver uses the channel estimate for equalization, wherein the channel estimates are produced based on the training sequences. (Col. 1, lines 29-42) The training sequences are produced using the scaling matrix as shown in Fig. 3. Fig. 4 shows a plurality of antennas, wherein the plurality of antennas would receive one or more sequences since each antenna would receive information.

n. **Claims 45 and 46**, Khayrallah et al discloses "each steering matrix has one column, and wherein each spatial filter matrix has a dimension of one by one" and "each steering matrix has N columns and each spatial filter matrix has a dimension of N by R, where N and R are integers greater than 2. (Fig. 6 shows the receiver performing channel estimation and equalization. Fig. 7 shows the

calculation of the channel estimation. Col. 7, line 58-Col.8, line 18 discloses the channel estimates are determined based on the scaling value matrix elements from the column corresponding to the antenna. Given the scaling value matrix is one by one, then the channel estimates would be a one by one matrix. Given the scaling value matrix is N by R, wherein N and R are integers greater than 2, the channel estimate would be a N x R matrix.)

o. **Claims 47 and 50** inherits all the limitations of claim 42.

p. **Claims 48-49 and 51-52** inherits all the limitations of claims 45 and 46.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. **Claims 11,13** are rejected under 35 U.S.C. 103(a) as being unpatentable over Khayrallah et al as applied to claim 1.

a. **Claim 11**, Khayrallah et al discloses "N is a power of two". (Col. 5, lines 32-40 discloses N >= M.) It would be obvious to one skilled in the art for N to be a power of two depends on the number of antennas as well as the inventors design choice.

b. **Claim 13** inherits all the limitations of claim 1, but claim 1 fails to recite the limitation "a memory operative to store the base matrix, or at least one steering matrix, or both the base matrix and the at least one steering matrix". Khayrallah et al discloses an apparatus on a processor, wherein memory is common in a processor. It would have been obvious to one skilled in the art at the time of the invention to incorporate a memory block to store the base matrix and/or steering matrix within the processor as disclosed by Khayrallah et al so to allow for easy access to the information.

5. **Claims 22-23,43-44** are rejected under 35 U.S.C 103(a) as being unpatentable over Khayrallah et al as applied to claim 21 in view of Khatri (US Patent No.: 7020490).

a. **Claims 22,43**,

i. Khayrallah et al fails to disclose "the multi-antenna communication system utilizes orthogonal frequency division multiplexing (OFDM), and wherein the plurality of transmission spans correspond to a plurality of subbands."

ii. Khatri discloses such limitations. (Col. 4, lines 53-56) It would have been obvious to one skilled in the to transmit using OFDM as disclosed by Khatri, wherein transmission signals are produced using orthogonal scaling as disclosed by Khayrallah et al so to provide independent phase and amplitude to avoid co-channel interference.

b. **Claims 23,44**,

i. Khayrallah et al fails to disclose "multi-antenna communication system utilizes orthogonal frequency division multiplexing (OFDM), and wherein each of the plurality of transmission spans corresponds to one or more subbands in one time interval."

ii. Khatri discloses such limitations. (Col. 4, lines 53-56 disclsoes sending information using different subbands and different carrier frequencies, wherein such subbands and carrier frequencies can be more than 1.) It would have been obvious to one skilled in the to transmit using OFDM as disclosed by Khatri, wherein transmission signals are produced using orthogonal scaling as disclosed by Khayrallah et al so to provide independent phase and amplitude to avoid co-channel interference.

Allowable Subject Matter

6. **Claims 3-5,7-9,14,16,18,20,27-28,30-31,37-3**8 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Linda Wong whose telephone number is 571-272-6044. The examiner can normally be reached on 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Payne can be reached on (571) 272-3024. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Linda Wong
2/12/2008

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SUPERVISORY PATENT EXAMINER